Cognitive Visual Integration Therapy - An Assessment

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John Gabrieli, neuroscientist at MIT and associate member of the McGovern Institute for Brain Research, commented that the human brain is like 100 billion computers all processing simultaneously, each computer does not necessarily work very fast, but it is the "massive parallel processing of the human brain" that is spectacular.

ocw.mit.edu (2011)

Background

This paper proposes that learning the basic skills, such as reading, writing, and mathematics, involves a highly complex set of inter-related steps and that this can be observed in some of the corrective therapies that are currently being used in the world today.

These are important therapies because they work with the mechanics of a person's cognition to significantly change a person's ability to learn. From those therapies it is possible to draw conclusions about steps that can be taken to:

a. Enhance child development, through better design of environment and stimulus material;
b. Correct delays to an individual's development.

The specific therapy that has been studied and observed is Cognitive Visual Integration Therapy (CVIT) which seeks to ensure that the cognitive pathways, controlling muscle systems and sensory systems, are functioning and fully integrated.

CVIT includes the following therapies:

a. Suppression of primary reflexes and mid-line crossing, through gross and fine motor skill exercises(1).
b. Behavioural Optometry Exercises(2). These must be performed under the supervision of a skilled practitioner. The objective is to develop the subject's eye control so that both eyes work smoothly together and send effective messages to the brain.

c. Graded cognitive exercises to develop, strengthen and ultimately integrate the links between the sensory system and the brain.
d. Tomatis therapy[3] (when appropriate) to develop the subject's ability to cognitively process auditory messages. This therapy also requires a trained practitioner to supervise the process.

It can take up to two years for individuals to work their way through a complete CVIT programme. The programme ends at the point at which the subject starts to be able to fill in the gaps in their learning and develop a holistic view of the world.

In theory, with all cognitive sensory pathways open, the subject is able to learn anything they choose provided that they make sufficient effort. It is not a panacea, but the programme is intended to remove neural blockages to cognitive processing so that those who complete the therapy are then able to develop skills in any chosen field.

Introduction

Study aims and rationale

The objective of this paper is to show the impact of a completed CVIT programme on a student's ability to cognitively process. The rationale for this is that CVIT is a complex integrated process, the individual components of which have each been assessed elsewhere for their effectiveness (see Appendix I).

CVIT is a relatively new concept in therapy and currently it is useful for readers to have an overview of the potential of an integrated, multi-disciplinary programme to significantly overcome barriers to learning that would have traditionally been seen as not possible to correct.

An understanding of how to overcome significant barriers to learning also leads to a greater understanding of how curriculum can be designed to:

- maximise cognitive development;
- minimise inadvertent damage to children's development;
- identify developmental problems early and minimise secondary emotional damage.

Study research questions

1. Can learning difficulties be overcome by taking an integrated approach to cognitive therapy?
2. Is it possible, through non-invasive therapy, to mimic key stages of development and hence enable individuals to improve their cognitive skills?
3. If cognitive integration therapy does work then what are the key development goals that every child needs to achieve in order to be a fully effective learner?

Methods

Research Design

The key variables selected to log for this study were largely determined by the therapy itself. In the UK, candidates present themselves for CVIT when they have exhausted other options; each candidate had already been diagnosed with an existing developmental disorder, as listed in the data in appendix II.

The first stage in CVIT is to undertake a quantitative assessment of gross motor skills, visual perception, auditory, and optometric skills.

A. Gross Motor Skills, mid-line crossing, and balance
   1. Sit ups
   2. Balance
   3. Skipping forwards and backwards
   4. Rhythm
   5. Angels in the snow

B. Visual Perception
   1. 100 square: use of and rotation
   2. Puzzle
   3. Memory
   4. Visual Motor Integration
   5. New York State Optometric Association (NYSOA) reading test *
   6. Test for Analytical Skills
   7. Test for Analytical Auditory Skills

C. Optometric Assessment
   1. Accommodation **
   2. Saccadic eye movement ***
   3. Visual Memory

Sampling Strategy

The sample data was provided by CVIT practitioners in UK and South Africa. The sample comprised students, from both the UK and South Africa, who had completed their therapy in about 2007. None of the sample undertook Tomatis Therapy as part of their overall therapy.

At that time, the intention was to create a sample that would provide the basis for a dialogue for further research into the effectiveness of CVIT. Significant barriers to increasing understanding have since been experienced by CVIT practitioners as medical research funders prefer to work on a few isolated factors. The nature of the problem, however - to get “the massive parallel processing of the human brain” to work correctly - requires many factors to be worked on simultaneously and in parallel.

Data collection

Data was logged by the practitioner at the start and end of the CVIT process. Each of the subjects had already received a diagnosis from another professional, such as an educational psychologist, and all had experienced problems with making academic progress at school and with controlling their behaviour.

Data analysis

Data was analysed: by child; by category of activity; and by the progress the child made in their skills over the course of the therapy.

Results

Describing the sample

The sample comprised 24 children who, at the start of therapy, were between the ages of 5.2 years and 14.6 years. The sample was largely clustered towards 5 to 8 year olds with one 10 year old, one 11 year old, and two 14 year olds. The children undertook CVIT in either South Africa or in the UK.

By the end of the therapy the children's ages were between 7 years and 14 years 8 months.

The therapy itself varied in length between 7 months and 40 months. Variation in the duration of the therapy was due to:

a. the underlying fitness of the children at the start; UK children tended to exhibit less development in gross motor skills due to culture and climate;
b. family commitment to the therapy; students are required to undertake exercises 6 days a week and many families found this a difficult commitment to sustain.
c. other underlying physiological conditions, such as astigmatism.

Describing the context

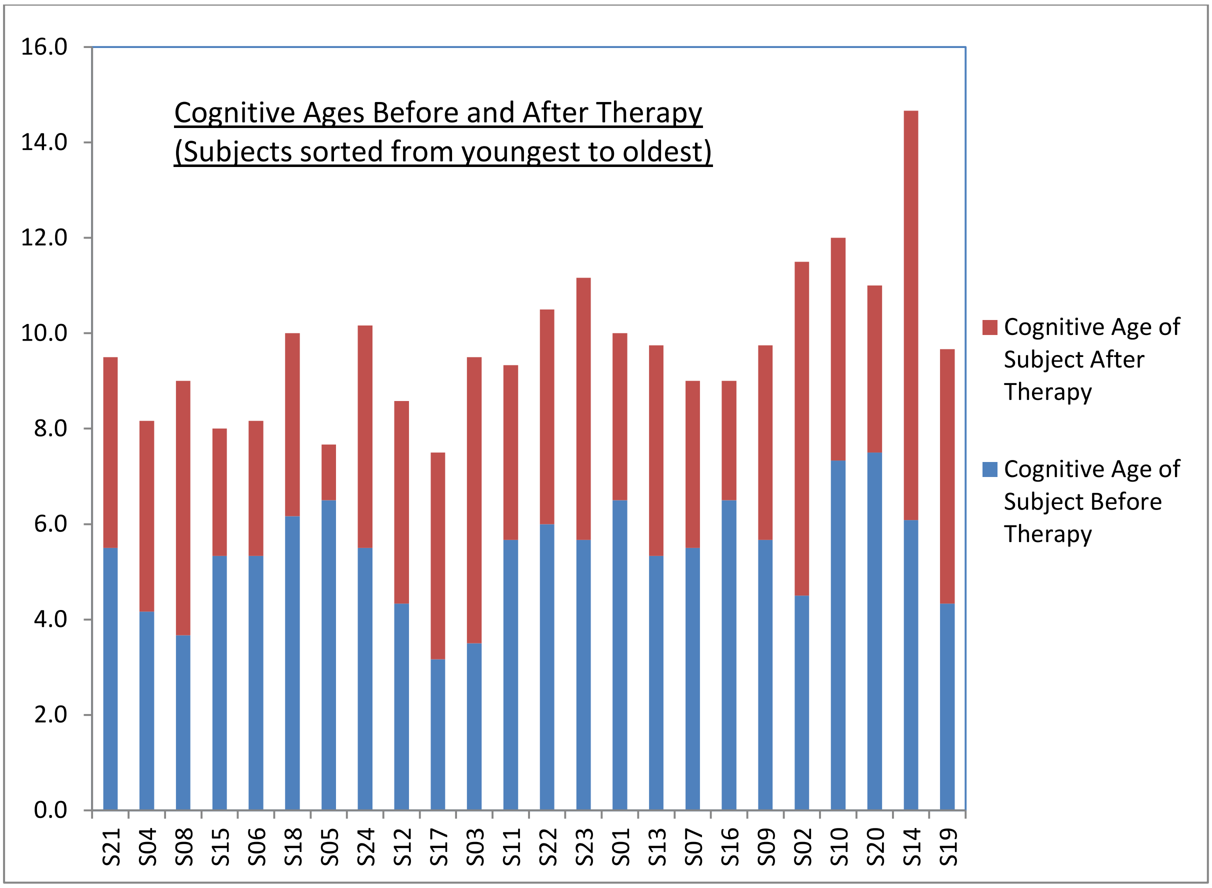
In South Africa, clients arrive at CVIT therapy as a result of self-referral or referral from a professional optometrist or educational psychologist. For example, Professor Drieinie Naude, Education Department, University of Pretoria, regularly refers students for CVIT assessment.

In the UK in 2007, parents tended to come to CVIT either by word of mouth from other parents or via South African social networks. Over time there have been increasing referrals from optometrists and university medical departments.

The objective of the parents was to help their children overcome barriers to learning which were usually causing the children considerable emotional distress. As the child's developmental age stalled, compared to their physical age, their distress and that of the parents tended to increase.

General points

The cognitive ages of the subjects before therapy were between 3.2 years and 7.5 years, with a mean age of 5.4 years. By the end of the therapy the cognitive ages of the subjects were between 7.5 years and 14.7 years, with a mean of 9.7 years.



Thus, there was a cognitive age increase for all subjects of between 1.2 years and 8.6 years, with a mean of 4.3 years. The cognitive age change, per month of therapy, was between 1.3 months and 11.4 months.

Throughout the therapy there was not a steady increase in cognitive age; it advanced in jumps at key points, such as shortly after the point when subjects gained the ability to use both eyes together, i.e. had binocular vision. Up until that point changes were not very obvious.

The first skills to show noticeable improvement are generally mathematical, as the individual develops the ability to see patterns and 3D for the first time. Before the end of the therapy the subjects tended to see an improvement in their ability to carry out comprehension exercises, as they learnt to develop the skill of differentiating relevant from irrelevant text in a passage.

Finally, at the end of the therapy, the whole sensory system was integrated with the visual system and the subject was able to picture a multi-sensory image in their mind's eye. This enabled the subjects to master the ability to write and read for meaning in a detailed and comprehensive way.

Conclusions

1. There is an inter-relationship between gross motor skills, stereopsis**** of vision and cognitive ability. By improving a person's gross motor skills and stereopsis of vision, their ability to cognitively process is improved. Good gross motor skills development is essential for good development of cognitive vision; cognitive visual development reinforces and encourages the development of gross motor skills, particularly balance. The inter-relationship between the development of motor skills and the cognitive sensory system, particularly vision, creates a diverse range of pathways to the brain. Good control over these pathways enables a person to interpret the world around them in order to behave appropriately and to learn from external stimuli.
2. It is possible to improve a person's cognitive development by improving their gross motor skills and stereopsis of vision and ensuring that they have cognitive sensory integration.
3. Intelligence is distributed in a spectrum. There is a spectrum of learning difficulties. Learning difficulties are defined as such when a person reaches a point when they can cognitively process significantly less than the norm.
4. If it is possible to significantly improve the cognitive processing skills of a person diagnosed as having learning difficulties, then it is also possible to improve the processing skills of people of average intelligence using similar methods, and thereby improve the average intelligence of the general population.
5. It is a real skill to change the cognitive skills of a person with significant learning difficulties and it takes expertise in a range of fields to unblock a serious developmental delay. For that small group it is worth investing in intensive specialist help, in order to avoid the long-term costs of not doing so. For that group, the work of therapists needs to be further assessed by independent experts in order to build a body of evidence in the UK and to develop such therapies as part of a mainstream approach to SEN.
6. For the mass of the population, undertaking the same exercises could potentially improve their ability to think at the highest levels and prepare them better for a knowledge-based economy, as well as compensate for the effects of living in a screen-based culture. There are not enough skilled personnel to work with the whole population on these issues; it takes at least four years to train in all the necessary areas (and requires considerable close supervision by a skilled practitioner) so there are fundamental barriers to solving that skills shortage, even in the long-term.
7. A general programme of exercises could be undertaken by all, except those needing specialist help, through schools, sports clubs, and community groups.

On-line tools can be used to offer such a programme en masse with built in checks and assessments. Support would also be needed to: brief instructors; help where there are problems of understanding; and provide a set of equipment for exercises that require cognitive tactile interaction. Through such standardisation it should be possible to identify which centres are most effective and identify why and how other centres can improve their programme delivery in order to make their performance more effective. It could also identify individuals who are high achieving in most areas, but have one persistent block in their understanding, which in the past would have been ignored, but could potentially be corrected by specialist help.

Explanation of terms

* NYSOA Reading Test: A vision screening battery developed by a project team of the New York Optometric Association. This battery screens those visual skills that are important to academic task demands.

** Accommodation: The ability of the lens to change its focus from distant to near objects. It is achieved through the action of the ciliary muscles that change the shape of the lens.

*** Saccadic eye movement: A rapid intermittent eye movement which occurs when the eyes fix on one point after another in the visual field.

**** Stereopsis of vision: The visual perception of depth, or the ability to see three-dimensionally. For this to occur, the person must have binocular vision.
Binocular vision is the ability to maintain visual focus on an object with both eyes, creating a single visual image.

Bibliography

(1) S.Goddard-Blythe, (2012) *Assessing Neuromotor Readiness for Learning*, Wiley-Blackwell, U.K.

(2) M.M.Scheiman and M.W.Rouse, (2006) *Optometric Management of Learning-Related Vision Problems*, Mosby Elsevier, U.S.A.

(3) Gilmore, Tim (1999). "*The Efficacy of the Tomatis Method for Children with Learning and Communication Disorders: A Meta-Analysis*". International Journal of Listening Vol. 13:12

Appendices

1. Gross Motor Skills

Research in this area has come under the field of neuromotor skills and is led by Sally Goddard Blythe of INPP.

"*There has been a growing body of evidence to support the theory that immature primitive and postural reflexes can persist in the general school population and are linked to educational under-achievement*" (McPhillips et al.2000, Goddard Blythe 2001, McPhillips and Sheehy 2004, Taylor et al. 2004, Goddard Blythe 2005).

Furthermore, following exercises of any kind, and targeted exercises (INPP developmental movement programme) in particular, can significantly impact on cognitive development (gain of 22.5 months in reading compared to a gain of 8.5 months in the comparison group, over three school terms), according to the Report on the use of a Neuro-Motor Test Battery and Developmental Movement Programme in Schools in Northumberland and Berkshire, Sally Goddard Blythe MSc. FRSA , Paper presented at The Institute for Neuro-Physiological Psychology Conference. April 11th and 12th 2010 in Miami, Florida.

2. Cognitive Development and stereopsis of vision

Improvements in performance following optometric vision therapy in a child with dyspraxia (Caroline M. F. Hurst, Sarah Van de Weyer, Claire Smith, Paul M. Adler, Ophthalmic and Physiological Optics, Volume 26, Issue 2, pages 199–210, March 2006.)

SS, an 8-year-old boy with dyspraxia, presented for behavioural optometry assessment. He had been diagnosed with a subtle form of dyspraxia by his paediatric occupational therapist, based on poor proprioception, delayed bilateral integration and poor visual perception. A full visual assessment was carried out.

SS was given a programme of reflex inhibition exercises for 3 months. Then, a programme of optometric vision therapy (OVT) exercises was prescribed at home and in practice for a period of 8 months. SS was assessed using a battery of occupational therapy Sensory Integration and Praxis Tests (SIPT) before optometric intervention, and after OVT. There were significant improvements in fusional reserves, accommodative facility and oculomotor control of pursuit and saccadic eye movements. His reading level had increased by 4 years in 11 months.

US research into cognitive visual delays is better documented than the UK experience. The following paper summarises the situation in the US: EQUITY MATTERS: Research Review No. 6, *Healthier Students Are Better Learners: A Missing Link in School Reforms to Close the Achievement Gap* (Charles E. Basch, March 2010; A Research Initiative of the Campaign for Educational Equity, Teachers College, Columbia University)

3. Tomatis Therapy Research

The Effects of The Tomatis Method of Auditory Stimulation on Auditory Processing Disorder: A Summary of Findings (Deborah Ross-Swain Ed.D., CCC Speech-Language Pathologist, Owner/Director of The Swain Center & The Listening Centers. International Journal of Listening, Vol. 21, Number 2, 2007).

The study's purpose was to determine the efficacy of the Tomatis Method of auditory stimulation as a therapeutic intervention for Auditory Processing Disorders (APD).

41 subjects (18 females, 23 males; 4.3 to 19.8 years old) were evaluated for Auditory Processing Disorder. Performance in standardised tests indicated weaknesses with auditory processing skills. Each subject participated in a 90 hour Tomatis Method protocol and, once completed, each was re-evaluated to measure improvement.

All subjects demonstrated improvement with skills of immediate auditory memory, auditory sequencing, interpretation of directions, auditory discrimination and auditory cohesion. Pre & post treatment comparison indicated statistically significant differences in the aforementioned skills.

These results indicate that prior to treatment overall auditory discrimination skills of the 41 children were placed at the 14.33^{rd} percentile. Following treatment, auditory discrimination skills improved to the 68.07^{th} percentile, reflecting an average improvement of 53.74%. These findings suggest that the Tomatis Method of auditory stimulation can be effective as an intervention strategy for A.P.D.

4. Data

The students had been diagnosed as having the following learning difficulties:

S1. Dyslexic + ADD
S2. Dyslexia and learning difficulties, social difficulties
S3. Vision, learning and social difficulties
S4. ADD
S5. Learning difficulties
S6. Suppression and lazy eye
S7. Learning difficulties/reading problems/exam anxiety
S8. ADHD/Learning difficulties/Aspergers
S9. ADHD
S10. Dyslexia and learning difficulties, social difficulties
S11. ADD
S12. ADHD
S13. Dyslexia and learning difficulties
S14. Learning difficulties
S15. Learning difficulties
S16. Learning difficulties/reading problems/exam anxiety, ADD
S17 - S24. Data not currently available

1 - Gross Motor Skills Assessment

% Before and After Therapy

(Subjects ordered from youngest to oldest)

Name	DOB	Before %	After %	Change	% Change
S21	24/11/2000	63	78	16	25%
S04	09/06/2000	63	94	31	50%
S08	07/04/2000	28	88	59	211%
S15	28/01/2000	72	75	3	4%
S06	23/12/1999	28	75	47	167%
S18	21/12/1999	75	75	0	0%
S05	25/10/1999	50	100	50	100%
S24	28/09/1999	31	91	59	190%
S12	15/04/1999	28	91	63	222%
S17	30/03/1999	9	100	91	967%
S03	03/01/1999	31	100	69	220%
S11	23/12/1998	72	63	-9	-13%
S22	07/10/1998	50	100	50	100%
S23	15/09/1998	34	97	63	182%
S01	25/07/1998	66	97	31	48%
S13	22/07/1998	66	97	31	48%
S07	07/06/1998	31	75	44	140%
S16	30/05/1998	63	100	38	60%
S09	23/09/1997	53	100	47	88%
S02	26/02/1996	66	81	16	24%
S10	22/09/1995	81	63	-19	-23%
S20	09/07/1995	88	97	9	11%
S14	30/09/1992	66	34	-31	-48%
S19	30/02/1992	50	100	50	100%

Mean	52.6	86.2	33.6	120%
Std. Dev.	20.5	16.5	30.1	198%
Variance	419.2	273.4	907.1	392%

2 - Visual Perception Assessment

Before & After Therapy

Name	Age of Subject Before	Age of Subject After	Duration of Therapy (months)	Cognitive Age of Subject Before Therapy	Cognitive Age of Subject After Therapy	Cognitive Age Change (months)	Cognitive Age Change per month	Cognitive Age Increase (years)
S21	6.5	7.1	7	5.5	9.5	48	6.9	4.0
S04	5.2	7.0	22	4.2	8.2	48	2.2	4.0
S08	5.4	7.2	21	3.7	9.0	64	3.0	5.3
S15	6.6	7.4	10	5.3	8.0	32	3.2	2.7
S06	6.8	7.5	9	5.3	8.2	34	3.8	2.8
S18	6.6	7.5	11	6.2	10.0	46	4.2	3.8
S05	6.9	7.7	9	6.5	7.7	14	1.6	1.2
S24	7.3	8.0	9	5.5	10.2	56	6.2	4.7
S12	6.9	8.2	15	4.3	8.6	51	3.4	4.3
S17	5.2	8.5	40	3.2	7.5	52	1.3	4.3
S03	6.8	8.4	19	3.5	9.5	72	3.8	6.0
S11	6.6	8.5	23	5.7	9.3	44	1.9	3.7
S22	8.6	9.7	13	6.0	10.5	54	4.2	4.5
S23	8.8	9.3	7	5.7	11.2	66	9.4	5.5
S01	8.0	8.8	10	6.5	10.0	42	4.2	3.5
S13	7.8	8.9	14	5.3	9.8	53	3.8	4.4
S07	7.3	9.0	21	5.5	9.0	42	2.0	3.5
S16	8.3	9.1	10	6.5	9.0	30	3.0	2.5
S09	8.8	9.5	8	5.7	9.8	49	6.1	4.1
S02	8.8	11.3	30	4.5	11.5	84	2.8	7.0
S10	10.7	11.8	13	7.3	12.0	56	4.3	4.7
S20	11.0	11.9	11	7.5	11.0	42	3.8	3.5
S14	14.0	14.8	9	6.1	14.7	103	11.4	8.6
S19	14.6	15.3	9	4.3	9.7	64	7.1	5.3

Minimum	7.0	3.2	7.5	14.0	1.3	1.2
Mean	14.6	5.4	9.7	51.9	4.3	4.3
Maximum	40.0	7.5	14.7	103.0	11.4	8.6
Lower Quartile	9.0	4.5	8.9	42.0	3.0	3.5
Upper Quartile	19.5	6.1	10.3	58.0	4.8	4.8
Std. Deviation	8.1	1.1	1.6	18.2	2.5	1.5